## As you are working, get the program INVT

Have out:

* Calculators
* Ch. 9 Cheat sheet

We will learn calculator stuff about Ch. 9

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1. An SRS of 1500 American adults was taken. 38% said they were happy with their income level. Create a 95% confidence interval for the true proportion of American adults that are happy with their income level. Interpret your interval.

$n=1500$

$\hat{p}=0.38$

$C=95\%$

State
1) SRS
2) $n \geq 30$
3) pop $\geq 10n$

Check
1) stated
2) $n=1500 \geq 30$
3) there are more than 15,000 Am. adults

$$0.38 \pm 1.96\sqrt{\frac{(0.38)(0.62)}{1500}} = (0.35544, 0.40456)$$

$\hat{p}=\frac{x}{1500}$

We are 95% conf. that the true % of Am. adults happy w/ income is btw 35.544% and 40.456%

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2. An SRS of 2000 dog owners was taken. 18% of them said they would like to have a different pet. A national survey last year claimed that it was only 13%. Perform a test of significance to see if the true percent of dog owners that want a different pet has $\boxed{\text{increased.}}$ Use a 0.05 level of significance.

$n=2000$

$\hat{p}=0.18$

$p=0.13$

$\alpha=0.05$

State
1) SRS
2) $n \geq 30$
3) pop $\geq 10n$

Check
1) stated
2) $n=2000 \geq 30$
3) there are more than 20,000 dog owners.

$H_0: p=0.13$

$H_a: p>0.13$

$$z=\frac{0.18-0.13}{\sqrt{\frac{(0.13)(0.87)}{2000}}}=6.649$$

$P(z>6.649) = 1.484 \times 10^{-11}$

(Conclusion)

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**TRY THESE:**

1) We want to look at the percent of men who are left handed. We take a random sample and find that there are 503 out of 1150 males are left handed. Create a 96% confidence interval.

$$0.4374 \pm 2.054\sqrt{\frac{(0.4374)(0.5626)}{1150}} = (0.40735, 0.46743)$$

2) A recent study claims that by May, 65% of students will have "senioritis." You believe that this proportion is actually higher. You take a SRS in May of 93 HS students and find that 71 of them claim to have "senioritis." Test the claim at the 0.05 level of significance. $\hat{p}=71/93=0.763$

$H_0: p=0.65$

$H_a: p>0.65$

$$z=\frac{0.763-0.65}{\sqrt{\frac{(0.65)(0.35)}{93}}}=2.294$$

$P(z>2.294)=0.0109$

We reject Ho....

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1) 0.4374 ± (2.054)( ) = (0.40735, 0.46743)

We are 96% confident that the true % of left handed males is between

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## 10.2 notes

REVIEW:

| | STATISTIC (samples) | PARAMETER (populations) | |
|---|---|---|---|
| Proportion (%) | $\hat{p}$ | $p$ | Ch 9 |
| Mean | $\bar{x}$ | $\mu$ | Ch 10 |
| Std. Deviation | $s$ | $\sigma$ | |

***Try this problem...*** It has been claimed that the **average** math SAT score for high school students is 500 points. A random sample of 70 high school students finds that the average math SAT score is 525 points. The standard deviation of this sample is 60 points. Perform a test of significance to see if the **average** score has gone up. Use a 0.05 level of significance.

$500 = \mu$
$70 = n$
$525 = \bar{x}$
$60 = s$
$0.05 = \alpha$

***1- What are the conditions? Check them.***

| State | Check |
|---|---|
| 1) SRS | 1) stated random |
| 2) $n \geq 30$ | 2) $n = 70 \geq 30$ |
| 3) pop $\geq 10n$ | 3) there are more than 700 HS students |

***2- What are the hypotheses?***

$H_0: \mu = 500$

$H_a: \mu > 500$

***3- What is the test statistic?***

Not $z$. Now we are using $t$.

***Formula:***

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

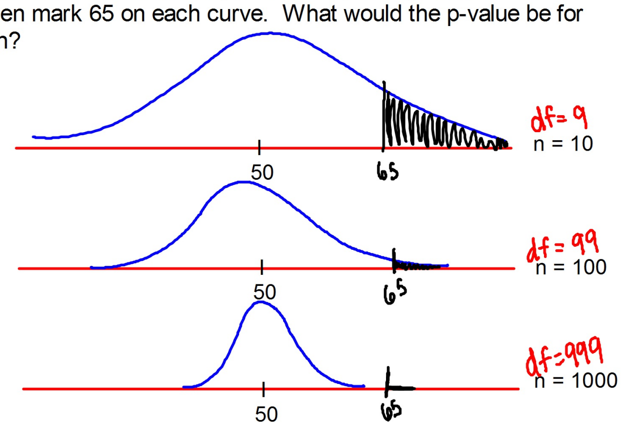
*Example:* $t = \dfrac{525-500}{60/\sqrt{70}} = 3.4861$

***4- What is the P-Value?***

$P(t > 3.4861)$

tcdf(

***P-Value notes:*** This time, sample size matters more!
- Draw the 3 distributions (n = 10, 100, 1000), center = 50
- Then mark 65 on each curve. What would the p-value be for each?




So when we test a mean, we have to take into account the sample size. We do this by writing something called:

degrees of freedom = $\boxed{df = n -- 1}$

** need to write this for each problem!

**CALCULATOR:**

P-Value: tcdf(lower bound, upper bound, df)

Example problem:

$P(t > 3.4861) = \text{tcdf}(3.4861, \text{E}99, 69)$
$= 4.284 \times 10^{-4}$

Conclusion:
Still the same two sentences.

We reject/fail to reject Ho b/c p-value is </> $\alpha$ = ____.

We have/do not have sufficient evidence that the true average of ____ is (Ha).

**Examples:**

1- The EPA wants to show that "the mean carbon monoxide level of air pollution is **higher** than 4.9 ppm." Does a random sample of readings (with sample results $\bar{x}$ = 5.1, n = 22, s = 1.17) present sufficient evidence at the 0.05 level of significance to support the EPA's claim? Perform a full test of significance. Assume the population is normal, so the small sample size is ok.

$H_o: \mu = 4.9$
$H_a: \mu > 4.9$

| State | Check |
|---|---|
| 1) SRS | 1) Stated |
| 2) $n \geq 30$ | 2) ok b/c pop is normal |
| 3) pop $\geq$ 10n | 3) there are going to be more than 220 readings |

$$t = \frac{5.1 - 4.9}{1.17/\sqrt{22}} = 0.8018$$

$P(t > 0.8018) = tcdf(0.8018, E99, 21)$
$= 0.2158$

df = 21

We fail to reject Ho b/c p-value of 0.2158 > $\alpha$ = 0.05.

We do not have sufficient evidence that the true avg. CO level is greater than 4.9 units.

2) The estimated U.S. intake of trans-fatty acids is 8 grams per day. Consider a research project involving 150 individuals in which their daily intake of trans-fatty acids was measured. Suppose the average fatty acid intake from this sample was 12.5 grams, with a standard deviation of 7.7 grams. Test to see if the average amount of trans-fatty acids has **increased** at $\alpha$ = 0.05.

$\bar{x}$ s

$H_o: \mu = 8$
$H_a: \mu > 8$

| State | Check |
|---|---|
| 1) SRS | 1) X |
| 2) $n \geq 30$ | 2) $n = 150 \geq 30$ |
| 3) pop $\geq$ 10n | 3) there are more than 1500 US indiv. |

$$t = \frac{12.5 - 8}{7.7/\sqrt{150}} = 7.158$$

df = 149

$P(t > 7.158) = tcdf(7.158, E99, 149) = 1.733 \times 10^{-11}$

We reject Ho b/c p-value of $1.733 \times 10^{-11} < \alpha = 0.05$.

We have suff. evid that the true avg. trans fatty intake is greater than 8 grams.

Try example #3

1) Conditions (you can assume random sample)
2) Hypotheses
3) Test Statistic
4) P-Value
5) Conclusion

3) $\mu$ = 8.2  n = 50  $\bar{x}$ = 9.1  s = 1.1  df = 49

Ho: $\mu$ = 8.2
Ha: $\mu \neq$ 8.2

$$t = \frac{9.1 - 8.2}{\frac{1.1}{\sqrt{50}}} = 5.785$$

2*P(t > 5.875) = 5.002 x $10^{-7}$

We reject Ho b/c p-value of 5.002 x $10^{-7}$ is < $\alpha$ = 0.01.
We have sufficient evidence that the true average hospital stay is not 8.2 days.

***Try this problem:***

A random sample of size 60 is taken from the weights of babies born at Northside Hospital during the year 1994. A mean (**average**) of 6.87 lb and a standard deviation of 1.76 lb were found for the sample. Estimate the true **average** weight of all babies born in this hospital in 1994, using a **95% confidence interval**.

n

$\bar{x}$

s

m

***Formula for a confidence interval for a mean (average):***

$$\bar{x} \pm t^*\left(s/\sqrt{n}\right) = (a, b)$$

$$6.87 \pm (2.001)\left(1.76/\sqrt{60}\right) = (6.4153, 7.3247)$$

$$6.87 \pm 0.4547$$

Where do we find the t* from?

USE CALCULATOR InvT program

n Conf.

Example problem:

We are 95% conf. that the true average weight of babies born @ Northside Hospital in 1994 is btw. 6.4153 lbs. & 7.3247 lbs.

**Examples:**

4- A survey was conducted involving 250 families living in a city. The average amount of income tax paid per family in the sample was $3540 with a standard deviation of $1150. Establish and interpret a 99% confidence interval estimate for the taxes paid by families in this city.

$n = 250$

$\bar{x} = 3540$

$s = 1150$

$C = 99\%$

$df = 249$

$$3540 \pm (2.596)\left(1150/\sqrt{250}\right)$$

$$= (3351.187, 3728.813)$$

We are 99% conf. that the true average amount of income tax paid by families in the city is btw $3351.19 and $3728.81.

Try example #5

5) $n = 36$ $\bar{x} = 16.1$ $s = 0.11$ $df = 35$

$$16.1 \pm (1.690)(0.11/\sqrt{36}) = (16.069, 16.131)$$

We are 90% confident that the true average ounces of cola in a bottle is between 16.069 and 16.131 oz.

WORKSHEET #1- 3